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最終頁に続く

(54)【発明の名称】新規微生物およびそれを用いた汚泥処理方法

(57)【要約】
【課題】汚泥の減容化もしくは発生をなくす方法を提供する。
【解決手段】バチルス属細菌、特にバチルス sp. Q2-1株（生命工研菌寄第16922号）および／またはバチルス sp. Q3株（生命工研菌寄第16923号）を用いて、高アルカリ性、40℃以上で汚泥を処理する。
【効果】新規な汚泥分解微生物で汚泥を処理することにより、汚泥の高効率処理が可能となった。

1

【特許請求の範囲】

【請求項１】バチルス属に属し、アルカリ性条件にて汚泥を分解する能力を有する新規微生物。

【請求項２】バチルス属に属し、アルカリ性条件および４０℃以上の温度で汚泥を分解する能力を有する新規微生物。

【請求項３】アルカリ性条件がｐＨ８～１３である請求項１または２に記載の新規微生物。

【請求項４】ｐＨが９～１２である請求項３記載の新規微生物。

【請求項５】少なくともプロテアーゼ活性を持つ請求項１から４のいずれかに記載の新規微生物。

【請求項６】汚泥を分解する能力を有する生命工研菌寄第１６９２２号として寄託されたバチルス sp. Q2-1株。

【請求項７】汚泥を分解する能力を有する生命工研菌寄第１６９２３号として寄託されたバチルス sp. Q3株。

【請求項８】バチルス属に属する微生物を単独あるいは混合して汚泥に添加し、アルカリ性条件にて処理することを特徴とする汚泥処理方法。

【請求項９】温度が４０℃以上である請求項８記載の汚泥処理方法。

【請求項１０】アルカリ性条件がｐＨ８～１３である請求項８または９に記載の汚泥処理方法。

【請求項１１】ｐＨが９～１２である請求項１０記載の汚泥処理方法。

【請求項１２】バチルス属に属する微生物の少なくとも一つが、少なくともプロテアーゼ活性をもつ請求項８から１１のいずれかに記載の汚泥処理方法。

【請求項１３】バチルス属に属する微生物が請求項１から７のいずれかに記載の新規微生物である請求項８から１２のいずれかに記載の汚泥処理方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、活性汚泥法による排水処理で発生する汚泥を分解する新規微生物、および該微生物を使用した汚泥の減容化もしくは発生をなくす汚泥の処理方法に関するものである。

【０００２】

【従来の技術】現在の代表的な排水処理方法として活性汚泥法がある。活性汚泥法では、好気的条件下で微生物により排水中のBOD成分を分解させ、処理液を固液分離して上清を処理水として系外に排出する。固液分離で沈殿した汚泥の一部は曝気槽に返送する。余剰汚泥は、一部、土壌改良材、コンポスト材料として再利用されるが、大部分は処分する必要がある。余剰汚泥の処分方法としては、脱水、焼却などの前処理をした後、埋め立てなどで廃棄する方法が主流である。この方法では大量に発生する余剰汚泥の処理に、大きな動力を消費する脱水機や乾燥機を用意する必要がある。焼却する場合には大

2

量の熱エネルギーが必要となる。また埋め立て処分場所の逼迫や規制の問題で埋め立て廃棄費用は年々上昇してきている。

【０００３】これに対し、汚泥を減容化して余剰汚泥発生量を減らす方法が各種試みられている。余剰汚泥の減容化を行う既存技術としては嫌気消化法があるが、滞留時間が１０～３０日かかり、装置規模が大きくなるため普及していない。

【０００４】そのほかに提案されている方法としては、物理化学的方法や、生物的方法、各種の汚泥前処理工程と組み合わせた生物的方法による汚泥減容化などがある。

【０００５】特開平4-78496号公報にある湿式酸化による汚泥の処理、特開平9-276900号公報にある超臨界水による汚泥の処理などは、物理化学的方法を用いた汚泥減容化方法である。

【０００６】生物的方法では、特表平6-509986号公報にある好熱性生物消化と中温性生物消化を繰り返すことにより汚泥の減容化をする方法などがある。

【０００７】各種前処理工程と組み合わせた生物的方法では、汚泥を化学的または物理的に前処理した後、嫌気的あるいは好気的に微生物処理する方法などが検討されている。これは汚泥を強制的に前処理することにより、後段の微生物による処理時間を短縮することを狙った方法である。例えば特開昭59-105897号公報は、汚泥をオゾンで前処理をして、嫌気性消化法の消化効率を向上させるものである。特開平7-116685号公報、特開平8-19789号公報はオゾンで汚泥細胞壁を処理した後、好気槽で汚泥の減容化を行うものであり、特開平3-8496号公報では汚泥にアルカリまたは鉱酸を添加して、アルカリ条件または酸性条件下で処理した後に好気処理するものである。特開平4-326998号公報、特開平5-345200号公報は汚泥をアルカリ性にすると同時に加温することで熱アルカリ処理を行って可溶化を進めた後、中性付近で嫌気処理をする方法である。さらに特開平8-229595号公報、特開平8-243595号公報は汚泥の加温処理による可溶化を行う方法である。特開昭58-76200号公報は、超音波で汚泥を前処理し、嫌気消化法の消化効率を向上するものである。特開平9-117800号公報は、汚泥を界面活性剤存在下で加熱処理して汚泥を可溶化処理した後、曝気槽に返送することで汚泥処理を行うものである。特開平9-206785号公報は、汚泥を嫌気性処理した後、オゾン処理または高圧パルス放電処理をおこない、嫌気性処理工程に返送することで汚泥の減容化をおこなうものである。特公昭57-19719号公報、特開平6-206088号公報は汚泥をオゾン処理して曝気槽に返送し、汚泥を処理するものである。特開平8-1183号公報は、汚泥をオゾン処理と加熱処理をして、曝気槽に返送することで汚泥を処理するものである。特開平9-10791号公報は、汚泥を高温処理した後、曝気槽に返送することで汚泥を処理するものである。ま

た、汚泥可溶化手段として特開平9-253699号公報にあるように好熱性微生物を添加する方法も提案されている。

【０００８】特開平9-136097号公報にあるようにアルカリ性条件下で好気性微生物の存在下で曝気して生物処理工程に返送する汚泥処理方法も提案されているが、これはアルカリ添加による可溶化後に中和のために添加する酸薬品量を従来よりも少なくすることを目的としたものである。

【０００９】しかしこれまでの湿式酸化、超臨界水、超音波、オゾン、高圧パルス放電などの汚泥処理方法は設備やランニングコストが高くつく。好熱性生物消化と中温性生物消化を繰り返す方法では多くの槽が必要となる。酸やアルカリ、界面活性剤を添加する方法は使用薬品のコストが問題となる。さらに、酸やアルカリを添加した場合には中和のための設備および薬品コストも必要である。高温に加熱する方法では加熱のためのコストアップが問題となっている。また、汚泥を前処理した後、嫌気的あるいは好気的に微生物処理する方法では、少なくとも前処理槽と微生物処理槽が必要になり、スペースを多くとる点なとが問題となる。微生物処理槽を活性汚泥槽と兼用し、前処理した汚泥を返送する場合でも、前処理工程では汚泥を可溶化するのみでBOD負荷自体は処理前とほとんど変わっていないため、活性汚泥槽の負荷を大きく上げてしまい、活性汚泥槽の処理能力に余裕がある場合にしか適用できないといった問題があり、少ない槽構成で汚泥の可溶化のみならず減容化を大幅に行うことのできる方式が望まれている。

【００１０】

【発明が解決しようとする課題】活性汚泥法による排水処理の問題点の一つとして、余剰汚泥の発生があげられる。本発明の目的は、汚泥の減容化もしくは発生をなくす方法を提供することである。

【００１１】

【課題を解決するための手段】本発明者らは、より高効率に汚泥の減容化を行うため鋭意検討した結果、高アルカリ性・高温という微生物の生育には不適な汚泥可溶化条件で生育可能な、汚泥分解能を持つ新規な微生物を取得し、該微生物を汚泥に添加することにより、長期間の馴養を必要とせず、かつ汚泥を画期的に減容化できることを見出し、本発明に至った。

【００１２】

【発明の実施の形態】以下、本発明を詳細に説明する。

【００１３】本発明では、高アルカリ性・高温という微生物の成育には不適な汚泥可溶化条件で生育可能な、汚泥分解能を持つ新規な微生物を取得し、該微生物を利用することにより、高アルカリ性・高温条件で汚泥を可溶化すると同時に微生物による汚泥の分解を行うことを目標とした。

【００１４】本発明で明らかにされる新規な汚泥分解微生物は、「活性汚泥法により発生する汚泥を含有する培養液を、ｐＨが８以上の条件下で培養することを特徴とする、汚泥分解微生物の取得方法。」で取得することができる。すなわち、以下のような取得方法を用いることができる。

【００１５】（１）活性汚泥法により発生する汚泥を含有する培養液を、ｐＨが８以上の条件下で培養することを特徴とする、汚泥分解微生物の取得方法。

【００１６】（２）条件としてｐＨが９以上１２以下に維持されることを特徴とする（１）の汚泥分解微生物の取得方法。

【００１７】（３）温度条件が４０℃以上であることを特徴とする（１）または（２）記載の汚泥分解微生物の取得方法。

【００１８】（４）好気的条件であることを特徴とする（１）乃至は（３）記載の汚泥分解微生物の取得方法。

【００１９】（５）一旦ｐＨを９以上まで上昇させることを特徴とする（１）乃至は（４）記載の汚泥分解微生物の取得方法。

【００２０】（６）一旦ｐＨを９以上にまで上昇させることを繰り返す事を特徴とする（５）記載の汚泥分解微生物の取得方法。

【００２１】（７）一旦ｐＨを９以上まで上昇させたのち、ｐＨを徐々に低下させることを特徴とする（５）記載の汚泥分解微生物の取得方法。

【００２２】（８）ｐＨを８以上に維持するために使用する薬剤として、水酸化カルシウム、水酸化ナトリウム、炭酸ナトリウムから選ばれた少なくとも１種以上を使用することを特徴とする（１）記載の汚泥分解微生物取得方法。

【００２３】ｐＨが８以上の条件で培養することにより、この条件下で優先的に生育し、汚泥を含有する培養液を栄養源とする、すなわちこの培養液を分解処理する能力を有する微生物の比率を高め、究極的にはそれのみにすることが可能となる。また、この微生物の能力を更に高め、あるいは更に顕在化させる事も可能となる。すなわち、汚泥を含有する培養液を特定の条件下で培養し、微生物の生育が認められた後、新たな培養液にその一部を移して更に培養を続ける作業を繰り返すことで、汚泥分解に関与する微生物が集積され、分解活性をある程度まで高めることができる。更にこの微生物を種として連続的に培養を繰り返すことにより、その活性を安定化することができる。なお、低下した結果の最低ｐＨは８以上であるべきであるが、最適ｐＨが８から１０の微生物の中には、限界生育ｐＨが中性以下のものも多く存在するため、有機酸などによるｐＨの低下現象が進みすぎたり、ｐＨを上げる操作が若干遅れたりして、一時的にｐＨが８を下回ることがあっても良いし、保存状態にしたり、微生物取得作業や汚泥処理作業を休止する際にもｐＨが８を下回ることがあってもよい。

【００２４】本発明におけるアルカリ化の方法には、例

5

えば水酸化ナトリウム、水酸化カリウム、水酸化カルシウム、水酸化マグネシウム、炭酸ナトリウム、炭酸水素ナトリウムなどの添加が挙げられるが、最も好ましいのは水酸化カルシウム、または水酸化ナトリウム、炭酸ナトリウムを単独あるいは併用して用いる事である。添加量は、汚泥の種類、温度、状態によって異なるが、ｐＨ８以上を達成できる量であればよく、固体状態または水溶液の状態で添加すればよい。例えば炭酸ナトリウムの場合、ＭＬＳＳ濃度が２０ｇ／Ｌの汚泥に対し、総重量の０．１％の添加でｐＨを８．５まで上げることができる。水酸化カルシウム、水酸化ナトリウムの場合は、更に少量の添加でより高アルカリにすることができるが、その分汚泥に対する可溶化作用が強いため、汚泥分解物によってｐＨが低下しやすい傾向を示す。また、炭酸ナトリウムは、ｐＨ緩衝作用によって初期のｐＨをある程度維持する傾向が見られる。そこで、これらの試薬の組み合わせみよって、より適正な処理条件が得られる。また水酸化カルシウムを使用した場合、処理汚泥の沈降性が向上する。恐らくカルシウムイオンの一部が何らかの

6

形で汚泥中に取り込まれるためであろうと推測されるが、詳細は不明である。比較的安価な水酸化カルシウムをアルカリ化剤の一部または全部に使用することは、減容化処理後の汚泥を処分する上でも、意味のあることであると思われる。

【００２５】本発明で汚泥処理に用いられる微生物は、アルカリ性条件（ｐＨ８～１３好ましくは９～１２の範囲）、好ましくはアルカリ性条件および４０℃以上の範囲で生育可能な汚泥分解能を持つ微生物であればよいが、バチルス sp. Q2-1株（生命工研菌寄第16922号）、バチルス sp. Q3株（生命工研菌寄第16923号）、またはその組み合わせが好ましい。これら２株の生理学的性質を表１から４に示す。生理学的性質の確認方法は、改訂版微生物の分類と同定＜下＞、長谷川武治編著、学会出版センター（1990）に従った。培養でｐＨをアルカリ性にする場合には、炭酸ナトリウムまたは水酸化ナトリウムを添加することで調整した。

【００２６】

【表１】

表１　新規微生物の性質

| 微生物名 | | バチルス・スピーシズ（*Bacillus sp.*）Ｑ２－１株 | バチルス・スピーシズ（*Bacillus sp.*）Ｑ３株 |
|---|---|---|---|
| 生命工研菌寄番号 | | 16922 | 16923 |
| （ａ）形態（肉汁寒天培地、ｐＨ 10、45℃） | | | |
| (1) 細胞の形、大きさ | | 桿菌、3.2 μｍ×0.4 μｍ | 桿菌、3.2 μｍ×0.4 μｍ |
| (2) 多形性 | | 無し | 無し |
| (3) 運動性 | | 有り | 有り |
| (4) 胞子形成 | | 有り | 有り |
| (5) グラム染色性 | | 陽性 | 陽性 |
| （ｂ）生育状態（ｐＨ 10、45℃） | | | |
| (1) 肉汁寒天平板培養 | | 白色、円形・隆起状コロニー形成 | 白色、円形・隆起状コロニー形成 |
| (2) 肉汁寒天培養 | | 強程度の濁り | 強程度の濁り |
| (3) 肉汁ゼラチン穿刺培養 | | 液化しない | 液化しない |
| (4) スキムミルク培養 | | 凝固しない | 凝固しない |
| (5) 生育ｐＨ範囲（肉汁寒天平板培地、45℃、培養２日） | ｐＨ 7 | + | ++ |
| | ｐＨ 10 | ++ | +++ |
| | ｐＨ 11 | + | + |
| (6) 生育温度範囲（肉汁寒天平板培地、ｐＨ 10、培養２日） | 30℃ | ++ | ++ |
| | 45℃ | +++ | +++ |
| | 50℃ | +++ | +++ |
| | 55℃ | - | ++ |
| | 60℃ | - | - |

生育状態：-：生育せず、+：やや生育する、++：よく生育する、+++：非常によく生育する

【００２７】

【表２】

表２　新規微生物の性質

| 微生物名 | | | パチルス・スピーシズ（*Bacillus sp.*）Ｑ２－１株 | パチルス・スピーシズ（*Bacillus sp.*）Ｑ３株 |
|---|---|---|---|---|
| 生命工研菌寄番号 | | | 16922 | 16923 |
| （ｃ）生理学的性質 | | | | |
| (1) 硝酸塩還元 | | | + | + |
| (2) 脱窒反応 | | | - | - |
| (3) ＶＰテスト | | | - | + |
| (4) インドール生成 | | | - | - |
| (5) 硫化水素生成 | | | - | - |
| (6) デンプン加水分解 | | | - | - |
| (7) クエン酸利用 | Ｋｏｓｅｒ培地 | | - | + |
| | Ｃｈｒｉｓｔｅｎｓｅｎ培地 | | + | - |
| (8) 無機窒素源利用 | 硝酸ナトリウム | | - | - |
| | 硫安 | | - | - |
| (9) 色素生成 | | | - | - |
| (10) ウレアーゼ | | | - | - |
| (11) オキシダーゼ | | | + | - |
| (12) カタラーゼ | | | + | + |
| (13) ＤＮＡーゼ | | | + | - |
| (14) 酸素に対する態度 | | | 好気性 | 好気性 |
| (15) ＯＦテスト | | | Ｏ | Ｆ |

【００２８】　　【表３】

表３　新規微生物の性質

| 微生物名 | | パチルス・スピーシズ（*Bacillus sp.*）Ｑ２－１株 | パチルス・スピーシズ（*Bacillus sp.*）Ｑ３株 |
|---|---|---|---|
| 生命工研菌寄番号 | | 16922 | 16923 |
| （ｃ）生理学的性質 | | | |
| (16) 糖からの酸の生成 | Ｌ－アラビノース | + | + |
| | Ｄ－キシロース | + | + |
| | Ｄ－グルコース | + | + |
| | Ｄ－マンノース | + | + |
| | Ｄ－フラクトース | + | + |
| | Ｄ－ガラクトース | + | + |
| | マルトース | + | + |
| | シュークロース | + | + |
| | ラクトース | + | - |
| | トレハロース | + | + |
| | Ｄ－ソルビトール | + | - |
| | Ｄ－マンニトール | + | + |
| | イノシトール | + | - |
| | グリセリン | + | + |
| | デンプン | - | - |

【００２９】　　【表４】

表４　新規微生物のプロテアーゼ活性

| 微生物名 | プロテアーゼ活性（吸光度280 ｎｍ／ｍｌ・分） | |
|---|---|---|
| | カゼイン培地培養時 | 汚泥培地培養時 |
| バチルス・スピーシズ（Ｂａｃｉｌｌｕｓ ｓｐ.）Ｑ２－１株 | ０．０ | ３９．５ |
| バチルス・スピーシズ（Ｂａｃｉｌｌｕｓ ｓｐ.）Ｑ３株 | ２．４ | ０．９ |

【００３０】結果をBergey's manual of systematic bacteriology volume 2 (1984) に照らし合わせた結果、これら２株はBacillus pumilus類縁の株であることがわかった。しかしこれら２株は硝酸塩還元が陽性である点、またバチルス sp. Ｑ２－１株はＶＰテストが陰性である点がBacillus pumilusと異なり、バチルス属に属する新菌種であった。

【００３１】本発明の新規微生物で処理する汚泥は、工業排水を活性汚泥法で処理した際に発生する汚泥を使用しているが、これに限定されるものではなく、ＢＯＤ負荷に菌体が多くあるような被処理材、たとえば下水汚泥などにも充分に適用できる。

【００３２】本発明の新規微生物を汚泥に添加する場合は、汚泥に種菌を加えて汚泥中で増殖させてもよいし、汚泥または培養液等で培養した微生物を培養液ごと、または微生物を濃縮して汚泥に添加してもよい。さらに微生物の分泌物を利用するために微生物の培養液上清を汚泥に添加してもよい。また、これらの添加方法を適宜組み合わせて使用してもよい。上記のように添加することで、高アルカリ性・高温での長期間の馴養を必要とせず、汚泥処理を開始することができる。

【００３３】本発明の新規微生物による汚泥処理のｐＨ条件は、ｐＨ８～１３、さらにはｐＨ９～１２が好ましい。これは、ｐＨが８以上であれば、加温のみを行ったときと比較して汚泥の可溶化が効率よく行えるが、高すぎるｐＨでは薬液コストが高くつく上に微生物の生育が困難になるためである。温度条件としては、４０℃以上８０℃以下、好ましくは４０℃以上６０℃以下が好ましい。一般的に微生物の繁殖に好ましいと考えられる生育条件は、ｐＨ中性付近、温度条件は室温付近である。たとえば活性汚泥槽の微生物は２０～３０℃であり最高でも３５℃前後とされている。汚泥処理条件を、高アルカリ性・高温条件にすることにより、汚泥を可溶化すると同時に、本発明の新規微生物を優先的に生育させることが可能となる。

【００３４】

【実施例】以下、実施例を用いて発明をさらに詳しく説明するが、本発明の範囲はこれに限定される物ではない。実施例中で用いた汚泥は、化学工場排水処理施設から採集した余剰汚泥をMLSSが20,000 ppmになるまで希釈したものを使用した。各実施例と比較例の結果は表５に示す。

【００３５】実施例１

乾燥ブイヨン（日水製薬）30 g/L、炭酸ナトリウム 10 g/Lの培養液5 mlを試験管（18 mm径×180 mm長）に入れ、滅菌した後Bacillus sp. Q2-1株（生命工研微生物寄第16922号）を植菌し、45℃で往復振盪120 rpmで24時間培養し、前培養液を得た。汚泥32 mlと炭酸ナトリウム100 g/L液4 mlを混合して200 ml容バッフル付きフラスコに入れ、前培用液4 mlを添加した。45℃で回転振盪120 rpmした。処理３日後のMLSS減容化率は４４．５％であった。

【００３６】実施例２

乾燥ブイヨン（日水製薬）30 g/L、炭酸ナトリウム 10 g/Lの培養液5 mlを試験管（18 mm径×180 mm長）に入れ、滅菌した後Bacillus sp. Q3株（生命工研微生物寄第16923号）を植菌し、45℃で往復振盪120 rpmで24時間培養し、前培養液を得た。汚泥32 mlと炭酸ナトリウム100 g/L液4 mlを混合して200 ml容バッフル付きフラスコに入れ、前培用液4 mlを添加した。45℃で回転振盪120 rpmした。処理３日後のMLSS減容化率は４３．７％であった。

【００３７】実施例３

実施例１と２で得たBacillus sp. Q2-1株（生命工研微生物寄第16922号）とBacillus sp. Q3株（生命工研微生物寄第16923号）の前培用液を用い、汚泥32 mlと炭酸ナトリウム100 g/L液4 mlを混合して200 ml容バッフル付きフラスコに入れ、前培用液各2 mlを添加した。45℃で回転振盪120 rpmした。処理３日後のMLSS減容化率は４４．８％であった。

【００３８】比較例１

汚泥32 mlと炭酸ナトリウム100 g/L液4 mlを混合して200 ml容バッフル付きフラスコに入れ、水 4 mlを添加した。45℃で回転振盪120 rpmした。処理３日後のMLSS減

容化率は２６．４％であった。

【００３９】

【表５】

表５　各実施例１～３と比較例１における処理３日でのＭＬＳＳ減容化率

| | ＭＬＳＳ減容化率 |
|---|---|
| 実施例１ | ４４．５％ |
| 実施例２ | ４３．７％ |
| 実施例３ | ４４．８％ |
| 比較例１ | ２６．４％ |

【００４０】

【発明の効果】本発明の実施により、従来の活性汚泥による排水処理工程に汚泥分解処理工程を設けると、汚泥の分解処理を行うことが容易に可能となるので、余剰汚泥の発生量を減少、または発生をなくすことが出来る。

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フロントページの続き

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(54) NEW MICROORGANISM AND TREATMENT OF SLUDGE USING THE SAME

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a new microorganism capable of reducing the amount of a generated excessive sludge or eliminating the generation thereof by providing the microorganism belonging to the genus Bacillus with the ability to decompose the sludge under alkaline conditions.
SOLUTION: This new microorganism belongs to the genus Bacillus and has the ability to decompose a sludge at ≥40° C temperature under alkaline conditions of pH 8-13, preferably 9-12. The new microorganism has a protease activity and is stipulated as Bacillus sp. Q2-1 strain (FERM P-16922) and is preferably used alone or mixed and added to a sludge to treat the sludge under the alkaline conditions.

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CLAIMS

[Claim(s)]
[Claim 1] The new microorganism which has the capacity which belongs to Bacillus and disassembles sludge in alkaline conditions.
[Claim 2] The new microorganism which has the capacity which belongs to Bacillus and disassembles sludge at alkaline conditions and the temperature of 40 degrees C or more.
[Claim 3] The new microorganism according to claim 1 or 2 whose alkaline conditions are pH 8-13.
[Claim 4] The new microorganism according to claim 3 whose pH is 9-12.
[Claim 5] A new microorganism given in either of claims 1-4 which have protease activity at least.
[Claim 6] Bacillus deposited as a life **** mycoparasite No. 16922 which has the capacity which disassembles sludge sp.Q2-1 share.
[Claim 7] Bacillus deposited as a life **** mycoparasite No. 16923 which has the capacity which disassembles sludge sp.Q3 share.
[Claim 8] The sludge-disposal approach characterized for the microorganism belonging to Bacillus by independent or mixing, adding to sludge and processing in alkaline conditions.
[Claim 9] The sludge-disposal approach according to claim 8 that temperature is 40 degrees C or more.
[Claim 10] The sludge-disposal approach according to claim 8 or 9 that alkaline conditions are pH 8-13.
[Claim 11] The sludge-disposal approach according to claim 10 that pH is 9-12.
[Claim 12] The sludge-disposal approach given in either of claims 8-11 in which at least one of the microorganisms belonging to Bacillus has protease activity at least.
[Claim 13] The sludge-disposal approach given in either of claims 8-12 whose microorganisms belonging to Bacillus are new microorganisms given in either of claims 1-7.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the art of sludge which abolishes reduction-izing or generating of sludge which used the new microorganism which disassembles the sludge generated in the waste water treatment by the activated sludge process, and this microorganism.
[0002]
[Description of the Prior Art] There is an activated sludge process as the current typical waste-water-treatment approach. In an activated sludge process, a microorganism is made to decompose the BOD component under wastewater under aerobic conditions, solid liquid separation of the processing liquid is carried out, and it discharges out of a system by using supernatant liquid as treated water. Some sludge which precipitated by solid liquid separation is returned to an aerator. Although a part of excess sludge is reused as soil amelioration material and a compost ingredient, it is necessary to dispose of most. As the disposal approach of excess sludge, after pretreating dehydration, incineration, etc., the approach of discarding by reclamation etc. is in use. It is necessary to prepare the dehydrator and dryer which consume big power for processing of the excess sludge generated in large quantities by this approach. In destroying by fire, a lot of heat energy is needed. Moreover, it reclaims land on a shortage of money of a reclamation disposal-field place, or the problem of regulation, and abandonment costs have been going up every year.
[0003] On the other hand, the approaches of reduction-izing sludge and reducing an excess sludge yield are various attempt ********. Although there is an anaerobic digestion method as an existing technique of performing reduction-ization of excess sludge, the residence time takes ten to 30 day, and since an equipment scale becomes large, it has not spread.
[0004] In addition, as an approach proposed, there is sludge reduction-ization by the physicochemical approach, and the living thing-approach and the living thing-approach combined with various kinds of sludge head end processes etc.
[0005] Processing of the sludge by the wet oxidation in JP,4-78496,A, processing of the sludge by the supercritical water in JP,9-276900,A, etc. are the sludge reduction-ized approaches of having used the physicochemical approach.
[0006] By the living thing-approach, there is the approach of carrying out reduction-ization of sludge etc. by repeating the thermophile digestion and mesophilic living thing digestion in the Patent Publication Heisei No. 509986 [ six to ] official report.
[0007] By the living thing-approach combined with various head end processes, after pretreating sludge chemically or physically, the approach of carrying out microorganism treatment aversion-wise or aerobically etc. is examined. By pretreating sludge compulsorily, this is the approach which aimed at shortening the processing time by the latter microorganism. For example, JP,59-105897,A pretreats sludge for ozone and raises the digestive effectiveness of an anaerobic digestion process. JP,7-116685,A and JP,8-19789,A perform reduction-ization of sludge by the aerobic tub, after processing a sludge cell wall for ozone, and in JP,3-8496,A, alkali or a mineral acid is added to sludge, and after processing under alkali conditions or acid conditions, it carries out an aerobic treatment. After JP,4-326998,A and JP,5-345200,A perform heat alkali treatment by warming at the same time it makes sludge into alkalinity and advance solubilization, they are the approach of carrying out aversion processing near neutrality. further -- JP,8-229595,A and JP,8-243595,A -- warming of sludge -- it is the approach of performing solubilization by processing. JP,58-76200,A pretreats sludge ultrasonically and improves the digestive effectiveness of an anaerobic digestion method. After JP,9-117800,A heat-treats sludge under surfactant existence and carries out solubilization processing of the sludge, it performs a sludge disposal by returning an aerator. After JP,9-206785,A carries out anaerobic treatment of the sludge, it performs ozonization or high-pressure pulse discharge processing, and performs reduction-ization of sludge by returning an anaerobic treatment process. JP,57-19719,B and JP,6-206088,A ozonize sludge, return it to an aerator, and process sludge. JP,8-1183,A processes sludge by carrying out ozonization and heat-treatment and returning sludge to an aerator. JP,9-10791,A processes sludge by returning an aerator, after carrying out high temperature processing of the sludge. Moreover, the approach of adding a thermophilic microorganism, as it is in JP,9-253699,A as a sludge solubilization means is also proposed.
[0008] Although the sludge-disposal approach which carries out aeration under existence of aerobic bacteria under alkaline conditions and which is returned to a biological treatment process is also proposed as it is in JP,9-136097,A, this aims at making fewer than before the amount of acid chemicals added for neutralization after solubilization by alkali addition.
[0009] However, a facility and a running cost attach highly the sludge-disposal approaches, such as old wet oxidation, supercritical water, a supersonic wave, ozone, and a high-pressure pulse discharge. By the approach of repeating thermophile digestion and mesophilic living thing digestion, many tubs are needed. As for the approach of adding an acid, alkali, and a surfactant, the cost of the chemical used poses a problem. Furthermore, when an acid and alkali are added, the facility for neutralization and chemical cost are also required. By the approach of heating to an elevated temperature, the cost rise for heating poses a problem. Moreover, after pretreating sludge, by the approach of carrying out microorganism treatment aversion-wise or aerobically, a pretreatment tub and a microorganism treatment tub are needed at least, and many tooth spaces are taken and it becomes **** with ******. A microorganism treatment tub is used also [ activated sludge tank ], since the BOD load itself has hardly changed processing before only by solubilizing sludge in a head end process even when returning the pretreated sludge, the load of an activated sludge tank is raised greatly, there is a problem that it can apply only when allowances are in the throughput of an activated sludge tank, and a method which can perform not only solubilization of sludge but reduction-ization sharply with little tub configuration is desired.
[0010]
[Problem(s) to be Solved by the Invention] Generating of excess sludge is raised as one of the troubles of the waste water treatment by the activated sludge process. The purpose of this invention is offering the approach of abolishing reduction-izing or generating of sludge.
[0011]
[Means for Solving the Problem] the sludge which can be grown on unsuitable sludge solubilization conditions for growth of a microorganism called high alkalinity and an elevated temperature as a result of inquiring wholeheartedly, in order that this invention persons may perform reduction-ization of sludge more efficient -- it resulted that prolonged acclimatization was not needed and-izing of the sludge could be carried out [ **** ] epoch-makingly in a header and this invention by acquiring a new microorganism with resolution and adding this microorganism to sludge.

[0012]
[Embodiment of the Invention] Hereafter, this invention is explained to a detail.
[0013] the sludge which can be grown on unsuitable sludge solubilization conditions for growth of a microorganism called high alkalinity and an elevated temperature by this invention -- by acquiring a new microorganism with resolution and using this microorganism, while solubilizing sludge by high alkalinity and the high temperature service, it aimed at disassembling the sludge by the microorganism.
[0014] The new sludge decomposition microorganism clarified by this invention is acquirable by "the acquisition approach of the sludge decomposition microorganism characterized by pH cultivating the culture medium containing the sludge generated with an activated sludge process under eight or more conditions." That is, the following acquisition approaches can be used.
[0015] (1) The acquisition approach of the sludge decomposition microorganism characterized by pH cultivating the culture medium containing the sludge generated with an activated sludge process under eight or more conditions.
[0016] (2) The acquisition approach of the sludge decomposition microorganism of (1) characterized by pH being maintained by 12 or less [ 9 or more ] as conditions.
[0017] (3) (1) characterized by temperature conditions being 40 degrees C or more, or the acquisition approach of a sludge decomposition microorganism given in (2).
[0018] (4) (1) characterized by being aerobic conditions, or the acquisition approach of a sludge decomposition microorganism given in (3).
[0019] (5) (1) characterized by once raising pH to nine or more, or the acquisition approach of a sludge decomposition microorganism given in (4).
[0020] (6) The acquisition approach of the sludge decomposition microorganism given in (5) characterized by repeating once raising pH or more to nine.
[0021] (7) The acquisition approach of the sludge decomposition microorganism given in (5) characterized by reducing pH gradually once raising pH to nine or more.
[0022] (8) The sludge decomposition microorganism acquisition approach given in (1) characterized by using at least one or more sorts chosen from the calcium hydroxide, the sodium hydroxide, and the sodium carbonate as drugs used in order to maintain pH or more to eight.
[0023] When pH cultivates on eight or more conditions, it grows preferentially under these conditions, and the culture medium containing sludge is made into a nutrient, namely, the ratio of the microorganism which has the capacity which carries out decomposition processing of this culture medium is raised, and it becomes possible to make it only it ultimately. Moreover, it becomes possible to heighten the capacity of this microorganism further or to also make it actualize further. that is, after cultivating the culture medium containing sludge under specific conditions and accepting growth of a microorganism, by repeating the activity which moves the part to new culture medium, and continues culture further, the microorganism which participates in sludge decomposition is accumulated and decomposition activity can be raised to some extent until. Furthermore, that activity can be stabilized by repeating culture for this microorganism continuously as a seed. In addition, although the lowered minimum pH of a result should be eight or more Since many following [ neutrality ] also exist [ optimum pH / the marginal growth pH ] in the microorganism of 8 to 10, Also in case the fall phenomenon of pH by an organic acid etc. may progress too much, or the actuation which raises pH may be overdue a little, pH may be temporarily less than 8, it is made a state of preservation or a microorganism acquisition activity and a sludge-disposal activity are stopped, pH may be less than 8.
[0024] Although addition of a sodium hydroxide, a potassium hydroxide, a calcium hydroxide, a magnesium hydroxide, a sodium carbonate, a sodium hydrogencarbonate, etc. is mentioned to the approach of the alkalinization in this invention, independent or using together and using are most desirable about a calcium hydroxide or a sodium hydroxide, and a sodium carbonate. What is necessary is just to add an addition in the state of a solid state or a water solution that what is necessary is just the amount which can attain eight or more pH, although it changes with the class of sludge, temperature, and conditions. For example, in the case of a sodium carbonate, MLSS concentration can raise pH by 0.1% of addition of AUW to 8.5 to the sludge of 20 g/L. In the case of a calcium hydroxide and a sodium hydroxide, it can be made more into high alkali by still more nearly little addition, but since the solubilization operation over the part sludge is strong, the inclination for pH to tend to fall with a sludge decomposition product is shown. Moreover, the inclination for a sodium carbonate to maintain early pH to some extent by pH buffer action is seen. Then, more proper processing conditions are acquired as these reagents should try to combine. Moreover, when a calcium hydroxide is used, the sedimentation nature of processing sludge improves. Although it is surmised that it will be because a part of calcium ion is incorporated in sludge in a certain form, it is unknown for details. It is thought that it is meaningful to use a comparatively cheap calcium hydroxide for a part or all of an alkalinization agent also when disposing of the sludge after reduction-ized processing.
[0025] the microorganism used for a sludge disposal by this invention -- alkaline conditions (pH 8-13 preferably the range of 9-12), and the desirable sludge which can be grown alkaline conditions and in 40 degrees C or more -- although what is necessary is just a microorganism with resolving power -- bacillus sp.Q2-1 share (life **** mycoparasite No. 16922) and bacillus sp.Q3 share (life **** mycoparasite No. 16923) or its combination is desirable. These two shares of physiological properties are shown in Tables 1-4. The symptom of a physiological property followed the classification of a revised edition microorganism, the work edited by <bottom> Takeharu Hasegawa, and Japan Scientific Societies Press (1990). [ of identification ] When pH was made into alkalinity by culture, it adjusted by adding a sodium carbonate or a sodium hydroxide.
[0026]
[Table 1]

表１　新規微生物の性質

| 微生物名 | | バチルス・スピーシズ（*Bacillus sp.*）Ｑ２－１株 | バチルス・スピーシズ（*Bacillus sp.*）Ｑ３株 |
|---|---|---|---|
| 生命工研菌寄番号 | | 16922 | 16923 |
| （ａ）形態（肉汁寒天培地、ｐＨ 10、45℃） | | | |
| (1) 細胞の形、大きさ | | 桿菌、3.2 μｍ×0.4 μｍ | 桿菌、3.2 μｍ×0.4 μｍ |
| (2) 多形性 | | 無し | 無し |
| (3) 運動性 | | 有り | 有り |
| (4) 胞子形成 | | 有り | 有り |
| (5) グラム染色性 | | 陽性 | 陽性 |
| （ｂ）生育状態（ｐＨ 10、45℃） | | | |
| (1) 肉汁寒天平板培養 | | 白色、円形・隆起状コロニー形成 | 白色、円形・隆起状コロニー形成 |
| (2) 肉汁寒天培養 | | 強程度の濁り | 強程度の濁り |
| (3) 肉汁ゼラチン穿刺培養 | | 液化しない | 液化しない |
| (4) スキムミルク培養 | | 凝固しない | 凝固しない |
| (5) 生育ｐＨ範囲（肉汁寒天平板培地、45℃、培養２日） | ｐＨ 7 | + | ++ |
| | ｐＨ 10 | ++ | +++ |
| | ｐＨ 11 | + | + |
| (6) 生育温度範囲（肉汁寒天平板培地、ｐＨ 10、培養２日） | 30℃ | ++ | ++ |
| | 45℃ | +++ | +++ |
| | 50℃ | +++ | +++ |
| | 55℃ | - | ++ |
| | 60℃ | - | - |

生育状態：-：生育せず、+：やや生育する、++：よく生育する、+++：非常によく生育する

[0027]
[Table 2]
表２　新規微生物の性質

| 微生物名 | | | バチルス・スピーシズ（*Bacillus sp.*）Ｑ２－１株 | バチルス・スピーシズ（*Bacillus sp.*）Ｑ３株 |
|---|---|---|---|---|
| 生命工研菌寄番号 | | | 16922 | 16923 |
| （ｃ）生理学的性質 | | | | |
| (1) 硝酸塩還元 | | | + | + |
| (2) 脱窒反応 | | | - | - |
| (3) ＶＰテスト | | | - | + |
| (4) インドール生成 | | | - | - |
| (5) 硫化水素生成 | | | - | - |
| (6) デンプン加水分解 | | | - | - |
| (7) クエン酸利用 | Ｋｏｓｅｒ培地 | | - | + |
| | Ｃｈｒｉｓｔｅｎｓｅｎ培地 | | + | - |
| (8) 無機窒素源利用 | 硝酸ナトリウム | | - | - |
| | 硫安 | | - | - |
| (9) 色素生成 | | | - | - |
| (10) ウレアーゼ | | | - | - |
| (11) オキシダーゼ | | | + | - |
| (12) カタラーゼ | | | + | + |
| (13) ＤＮアーゼ | | | + | - |
| (14) 酸素に対する態度 | | | 好気性 | 好気性 |
| (15) ＯＦテスト | | | Ｏ | Ｆ |

[0028]
[Table 3]

表３　新規微生物の性質

| 微生物名 | | パチルス・スピーシズ（Ｂａｃｉｌｌｕｓ ｓｐ．）Ｑ２－１株 | パチルス・スピーシズ（*Ｂａｃｉｌｌｕｓ* ｓｐ．）Ｑ３株 |
|---|---|---|---|
| 生命工研菌寄番号 | | 16922 | 16923 |
| （ｃ）生理学的性質 | | | |
| (16) 糖からの酸の生成 | Ｌ－アラビノース | + | + |
| | Ｄ－キシロース | + | + |
| | Ｄ－グルコース | + | + |
| | Ｄ－マンノース | + | + |
| | Ｄ－フラクトース | + | + |
| | Ｄ－ガラクトース | + | + |
| | マルトース | + | + |
| | シュークロース | + | + |
| | ラクトース | + | - |
| | トレハロース | + | + |
| | Ｄ－ソルビトール | + | - |
| | Ｄ－マンニトール | + | + |
| | イノシトール | + | - |
| | グリセリン | + | + |
| | デンプン | - | - |

[0029]
[Table 4]
表４　新規微生物のプロテアーゼ活性

| 微生物名 | プロテアーゼ活性（吸光度 280 ｎｍ／ｍｌ・分） | |
|---|---|---|
| | カゼイン培地培養時 | 汚泥培地培養時 |
| パチルス・スピーシズ（Ｂａｃｉｌｌｕｓ ｓｐ．）Ｑ２－１株 | ０．０ | ３９．５ |
| パチルス・スピーシズ（Ｂａｃｉｌｌｕｓ ｓｐ．）Ｑ３株 | ２．４ | ０．９ |

[0030] the result of having tested the result by comparison to Bergey's manual of systematic bacteriology volume 2 (1984) -- these two shares -- Bacillus pumilus -- it turned out that it is the stock of a relative. However, these two shares are the point that nitrate reduction is a positivity, and a bacillus. The sp.Q2-1 share was a new strain to which the point that VP test is negative belongs to Bacillus unlike Bacillus pumilus.
[0031] Although the sludge generated when waste industrial waters are processed with an activated sludge process is being used for the sludge processed by the new microorganism of this invention, it is not limited to this and can fully be applied to processed material which has many fungus bodies in a BOD load, for example, sludge etc.
[0032] When adding the new microorganism of this invention to sludge, every culture medium and a microorganism may be condensed and the microorganism which could add the seed fungus to sludge, could be made to increase in sludge, and was cultivated with sludge or culture medium may be added to sludge. In order to use the secrete of a microorganism furthermore, the culture supernatant of a microorganism may be added to sludge. Moreover, you may use it, combining these addition approaches suitably. By adding as mentioned above, high alkalinity, and an elevated temperature and prolonged acclimatization are not needed, but a sludge disposal can be started.
[0033] pH conditions of the sludge disposal by the new microorganism of this invention have desirable pH 9-12 to pH 8-13 and a pan. With [ pH ] eight [ or more ], this can solubilize sludge efficiently as compared with the time only of only warming, but it is because drug solution cost costs upwards dearly by too high pH and growth of a microorganism becomes difficult. As temperature conditions, 40 degrees C or more 60 degrees C or less are preferably desirable 40 degrees C or more 80 degrees C or less. The condition for growth generally considered to be desirable to propagation of a microorganism is near pH neutrality, and temperature conditions are near a room temperature. For example, the microorganism of an activated sludge tank is 20-30 degrees C, and the highest is also made into 35-degree-C order. It becomes possible to grow the new microorganism of this invention preferentially at the same time it solubilizes sludge by making sludge-disposal conditions into high alkalinity and a high temperature service.

[0034]
[Example] Hereafter, although invention is explained in more detail using an example, the range of this invention is not the object limited to this. What diluted the excess sludge collected from the chemistry industrial-liquid-waste treatment facility until MLSS was set to 20,000 ppm was used for the sludge used in the example. The result of each example and the example of a comparison is shown in Table 5.
[0035] Example 1 desiccation bouillon (NISSUI PHARMACEUTICAL) 30 g/L, sodium carbonate Culture medium 5 ml of 10 g/L was put into the test tube (diameter of 18 mm x180 mm length), after sterilizing, inoculation of the Bacillus sp.Q2-1 share (life **** microorganism **** No. 16922) was carried out, and it cultivated by both-way shaking 120 rpm at 45 degrees C for 24 hours, and preculture liquid was obtained. Sludge 32 ml and sodium-carbonate 100 g/L liquid 4 ml were mixed, it put into the flask with a 200 ml ** baffle, and before ****** 4 ml was added. Rotation shaking 120 rpm was carried out at 45 degrees C. The rate of the formation of MLSS reduction three days after processing was 44.5%.
[0036] Example 2 desiccation bouillon (NISSUI PHARMACEUTICAL) 30 g/L, sodium carbonate Culture medium 5 ml of 10 g/L was put into the test tube (diameter of 18 mm x180 mm length), after sterilizing, inoculation of the Bacillus sp.Q3 share (life **** microorganism **** No. 16923) was carried out, and it cultivated by both-way shaking 120 rpm at 45 degrees C for 24 hours, and preculture liquid was obtained. Sludge 32 ml and sodium-carbonate 100 g/L liquid 4 ml were mixed, it put into the flask with a 200 ml ** baffle, and before ****** 4 ml was added. Rotation shaking 120 rpm was carried out at 45 degrees C. The rate of the formation of MLSS reduction three days after processing was 43.7%.
[0037] Using Bacillus sp.Q2-1 share (life **** microorganism **** No. 16922) and Bacillus sp.Q3 share (life **** microorganism **** No. 16923) before ****** obtained in the example 3 examples 1 and 2, sludge 32 ml and sodium-carbonate 100 g/L liquid 4 ml were mixed, it put into the flask with a 200 ml ** baffle, and two before ****** ml each was added. Rotation shaking 120 rpm was carried out at 45 degrees C. The rate of the formation of MLSS reduction three days after processing was 44.8%.
[0038] Example of comparison 1 sludge 32 ml and sodium-carbonate 100 g/L liquid 4 ml are mixed, and it puts into a flask with a 200 ml ** baffle, and is water. 4 ml was added. Rotation shaking 120 rpm was carried out at 45 degrees C. The rate of the formation of MLSS reduction three days after processing was 26.4%.
[0039]
[Table 5]
表５　各実施例１～３と比較例１における処理３日でのＭＬＳＳ減容化率

| | ＭＬＳＳ減容化率 |
|---|---|
| 実施例１ | ４４．５％ |
| 実施例２ | ４３．７％ |
| 実施例３ | ４４．８％ |
| 比較例１ | ２６．４％ |

[0040]
[Effect of the Invention] If sludge decomposition down stream processing is prepared in the waste-water-treatment process by the conventional active sludge, since it will become possible easily by operation of this invention to perform decomposition processing of sludge, reduction or generating can be abolished for the yield of excess sludge.

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[Translation done.]

## TECHNICAL FIELD

[Field of the Invention] This invention relates to the art of sludge which abolishes reduction-izing or generating of sludge which used the new microorganism which disassembles the sludge generated in the waste water treatment by the activated sludge process, and this microorganism.

[Translation done.]

PRIOR ART

[Description of the Prior Art] There is an activated sludge process as the current typical waste-water-treatment approach. In an activated sludge process, a microorganism is made to decompose the BOD component under wastewater under aerobic conditions, solid liquid separation of the processing liquid is carried out, and it discharges out of a system by using supernatant liquid as treated water. Some sludge which precipitated by solid liquid separation is returned to an aerator. Although a part of excess sludge is reused as soil amelioration material and a compost ingredient, it is necessary to dispose of most. As the disposal approach of excess sludge, after pretreating dehydration, incineration, etc., the approach of discarding by reclamation etc. is in use. It is necessary to prepare the dehydrator and dryer which consume big power for processing of the excess sludge generated in large quantities by this approach. In destroying by fire, a lot of heat energy is needed. Moreover, it reclaims land on a shortage of money of a reclamation disposal-field place, or the problem of regulation, and abandonment costs have been going up every year.

[0003] On the other hand, the approaches of reduction-izing sludge and reducing an excess sludge yield are various attempt ********. Although there is an anaerobic digestion method as an existing technique of performing reduction-ization of excess sludge, the residence time takes ten to 30 day, and since an equipment scale becomes large, it has not spread.

[0004] In addition, as an approach proposed, there is sludge reduction-ization by the physicochemical approach, and the living thing-approach and the living thing-approach combined with various kinds of sludge head end processes etc.

[0005] Processing of the sludge by the wet oxidation in JP,4-78496,A, processing of the sludge by the supercritical water in JP,9-276900,A, etc. are the sludge reduction-ized approaches of having used the physicochemical approach.

[0006] By the living thing-approach, there is the approach of carrying out reduction-ization of sludge etc. by repeating the thermophile digestion and mesophilic living thing digestion in the Patent Publication Heisei No. 509986 [ six to ] official report.

[0007] By the living thing-approach combined with various head end processes, after pretreating sludge chemically or physically, the approach of carrying out microorganism treatment aversion-wise or aerobically etc. is examined. By pretreating sludge compulsorily, this is the approach which aimed at shortening the processing time by the latter microorganism. For example, JP,59-105897,A pretreats sludge for ozone and raises the digestive effectiveness of an anaerobic digestion process. JP,7-116685,A and JP,8-19789,A perform reduction-ization of sludge by the aerobic tub, after processing a sludge cell wall for ozone, and in JP,3-8496,A, alkali or a mineral acid is added to sludge, and after processing under alkali conditions or acid conditions, it carries out an aerobic treatment. After JP,4-326998,A and JP,5-345200,A perform heat alkali treatment by warming at the same time it makes sludge into alkalinity and advance solubilization, they are the approach of carrying out aversion processing near neutrality. further -- JP,8-229595,A and JP,8-243595,A -- warming of sludge -- it is the approach of performing solubilization by processing. JP,58-76200,A pretreats sludge ultrasonically and improves the digestive effectiveness of an anaerobic digestion method. After JP,9-117800,A heat-treats sludge under surfactant existence and carries out solubilization processing of the sludge, it performs a sludge disposal by returning an aerator. After JP,9-206785,A carries out anaerobic treatment of the sludge, it performs ozonization or high-pressure pulse discharge processing, and performs reduction-ization of sludge by returning an anaerobic treatment process. JP,57-19719,B and JP,6-206088,A ozonize sludge, return it to an aerator, and process sludge. JP,8-1183,A processes sludge by carrying out ozonization and heat-treatment and returning sludge to an aerator. JP,9-10791,A processes sludge by returning an aerator, after carrying out high temperature processing of the sludge. Moreover, the approach of adding a thermophilic microorganism, as it is in JP,9-253699,A as a sludge solubilization means is also proposed.

[0008] Although the sludge-disposal approach which carries out aeration under existence of aerobic bacteria under alkaline conditions and which is returned to a biological treatment process is also proposed as it is in JP,9-136097,A, this aims at making fewer than before the amount of acid chemicals added for neutralization after solubilization by alkali addition.

[0009] However, a facility and a running cost attach highly the sludge-disposal approaches, such as old wet oxidation, supercritical water, a supersonic wave, ozone, and a high-pressure pulse discharge. By the approach of repeating thermophile digestion and mesophilic living thing digestion, many tubs are needed. As for the approach of adding an acid, alkali, and a surfactant, the cost of the chemical used poses a problem. Furthermore, when an acid and alkali are added, the facility for neutralization and chemical cost are also required. By the approach of heating to an elevated temperature, the cost rise for heating poses a problem. Moreover, after pretreating sludge, by the approach of carrying out microorganism treatment aversion-wise or aerobically, a pretreatment tub and a microorganism treatment tub are needed at least, and many tooth spaces are taken and it becomes **** with ******. A microorganism treatment tub is used also [ activated sludge tank ], since the BOD load itself has hardly changed processing before only by solubilizing sludge in a head end process even when returning the pretreated sludge, the load of an activated sludge tank is raised greatly, there is a problem that it can apply only when allowances are in the throughput of an activated sludge tank, and a method which can perform not only solubilization of sludge but reduction-ization sharply with little tub configuration is desired.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] If sludge decomposition down stream processing is prepared in the waste-water-treatment process by the conventional active sludge, since it will become possible easily by operation of this invention to perform decomposition processing of sludge, reduction or generating can be abolished for the yield of excess sludge.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Generating of excess sludge is raised as one of the troubles of the waste water treatment by the activated sludge process. The purpose of this invention is offering the approach of abolishing reduction-izing or generating of sludge.

[Translation done.]

MEANS

[Means for Solving the Problem] the sludge which can be grown on unsuitable sludge solubilization conditions for growth of a microorganism called high alkalinity and an elevated temperature as a result of inquiring wholeheartedly, in order that this invention persons may perform reduction-ization of sludge more efficient -- it resulted that prolonged acclimatization was not needed and-izing of the sludge could be carried out [ **** ] epoch-makingly in a header and this invention by acquiring a new microorganism with resolution and adding this microorganism to sludge.
[0012]
[Embodiment of the Invention] Hereafter, this invention is explained to a detail.
[0013] the sludge which can be grown on unsuitable sludge solubilization conditions for growth of a microorganism called high alkalinity and an elevated temperature by this invention -- by acquiring a new microorganism with resolution and using this microorganism, while solubilizing sludge by high alkalinity and the high temperature service, it aimed at disassembling the sludge by the microorganism.
[0014] The new sludge decomposition microorganism clarified by this invention is acquirable by "the acquisition approach of the sludge decomposition microorganism characterized by pH cultivating the culture medium containing the sludge generated with an activated sludge process under eight or more conditions." That is, the following acquisition approaches can be used.
[0015] (1) The acquisition approach of the sludge decomposition microorganism characterized by pH cultivating the culture medium containing the sludge generated with an activated sludge process under eight or more conditions.
[0016] (2) The acquisition approach of the sludge decomposition microorganism of (1) characterized by pH being maintained by 12 or less [ 9 or more ] as conditions.
[0017] (3) (1) characterized by temperature conditions being 40 degrees C or more, or the acquisition approach of a sludge decomposition microorganism given in (2).
[0018] (4) (1) characterized by being aerobic conditions, or the acquisition approach of a sludge decomposition microorganism given in (3).
[0019] (5) (1) characterized by once raising pH to nine or more, or the acquisition approach of a sludge decomposition microorganism given in (4).
[0020] (6) The acquisition approach of the sludge decomposition microorganism given in (5) characterized by repeating once raising pH or more to nine.
[0021] (7) The acquisition approach of the sludge decomposition microorganism given in (5) characterized by reducing pH gradually once raising pH to nine or more.
[0022] (8) The sludge decomposition microorganism acquisition approach given in (1) characterized by using at least one or more sorts chosen from the calcium hydroxide, the sodium hydroxide, and the sodium carbonate as drugs used in order to maintain pH or more to eight.
[0023] When pH cultivates on eight or more conditions, it grows preferentially under these conditions, and the culture medium containing sludge is made into a nutrient, namely, the ratio of the microorganism which has the capacity which carries out decomposition processing of this culture medium is raised, and it becomes possible to make it only it ultimately. Moreover, it becomes possible to heighten the capacity of this microorganism further or to also make it actualize further. that is, after cultivating the culture medium containing sludge under specific conditions and accepting growth of a microorganism, by repeating the activity which moves the part to new culture medium, and continues culture further, the microorganism which participates in sludge decomposition is accumulated and decomposition activity can be raised to some extent until. Furthermore, that activity can be stabilized by repeating culture for this microorganism continuously as a seed. In addition, although the lowered minimum pH of a result should be eight or more Since many following [ neutrality ] also exist [ optimum pH / the marginal growth pH ] in the microorganism of 8 to 10, Also in case the fall phenomenon of pH by an organic acid etc. may progress too much, or the actuation which raises pH may be overdue a little, pH may be temporarily less than 8, it is made a state of preservation or a microorganism acquisition activity and a sludge-disposal activity are stopped, pH may be less than 8.
[0024] Although addition of a sodium hydroxide, a potassium hydroxide, a calcium hydroxide, a magnesium hydroxide, a sodium carbonate, a sodium hydrogencarbonate, etc. is mentioned to the approach of the alkalinization in this invention, independent or using together and using are most desirable about a calcium hydroxide or a sodium hydroxide, and a sodium carbonate. What is necessary is just to add an addition in the state of a solid state or a water solution that what is necessary is just the amount which can attain eight or more pH, although it changes with the class of sludge, temperature, and conditions. For example, in the case of a sodium carbonate, MLSS concentration can raise pH by 0.1% of addition of AUW to 8.5 to the sludge of 20 g/L. In the case of a calcium hydroxide and a sodium hydroxide, it can be made more into high alkali by still more nearly little addition, but since the solubilization operation over the part sludge is strong, the inclination for pH to tend to fall with a sludge decomposition product is shown. Moreover, the inclination for a sodium carbonate to maintain early pH to some extent by pH buffer action is seen. Then, more proper processing conditions are acquired as these reagents should try to combine. Moreover, when a calcium hydroxide is used, the sedimentation nature of processing sludge improves. Although it is surmised that it will be because a part of calcium ion is incorporated in sludge in a certain form, it is unknown for details. It is thought that it is meaningful to use a comparatively cheap calcium hydroxide for a part or all of an alkalinization agent also when disposing of the sludge after reduction-ized processing.
[0025] the microorganism used for a sludge disposal by this invention -- alkaline conditions (pH 8-13 preferably the range of 9-12), and the desirable sludge which can be grown alkaline conditions and in 40 degrees C or more -- although what is necessary is just a microorganism with resolving power -- bacillus sp.Q2-1 share (life **** mycoparasite No. 16922) and bacillus sp.Q3 share (life **** mycoparasite No. 16923) or its combination is desirable. These two shares of physiological properties are shown in Tables 1-4. The symptom of a physiological property followed the classification of a revised edition microorganism, the work edited by <bottom> Takeharu Hasegawa, and Japan Scientific Societies Press (1990). [ of identification ] When pH was made into alkalinity by culture, it adjusted by adding a sodium carbonate or a sodium hydroxide.
[0026]
[Table 1]

表１　新規微生物の性質

| 微生物名 | | バチルス・スピーシズ（*Bacillus sp.*）Ｑ２－１株 | バチルス・スピーシズ（*Bacillus sp.*）Ｑ３株 |
|---|---|---|---|
| 生命工研菌寄番号 | | 16922 | 16923 |
| （ａ）形態（肉汁寒天培地、ｐＨ 10、 45℃） | | | |
| (1) 細胞の形、大きさ | | 桿菌、3.2 μｍ×0.4 μｍ | 桿菌、3.2 μｍ×0.4 μｍ |
| (2) 多形性 | | 無し | 無し |
| (3) 運動性 | | 有り | 有り |
| (4) 胞子形成 | | 有り | 有り |
| (5) グラム染色性 | | 陽性 | 陽性 |
| （ｂ）生育状態（ｐＨ 10、 45℃） | | | |
| (1) 肉汁寒天平板培養 | | 白色、円形・隆起状コロニー形成 | 白色、円形・隆起状コロニー形成 |
| (2) 肉汁寒天培養 | | 強程度の濁り | 強程度の濁り |
| (3) 肉汁ゼラチン穿刺培養 | | 液化しない | 液化しない |
| (4) スキムミルク培養 | | 凝固しない | 凝固しない |
| (5) 生育ｐＨ範囲（肉汁寒天平板培地、45℃、培養２日） | ｐＨ 7 | + | ++ |
| | ｐＨ 10 | ++ | +++ |
| | ｐＨ 11 | + | + |
| (6) 生育温度範囲（肉汁寒天平板培地、ｐＨ 10、培養２日） | 30℃ | ++ | ++ |
| | 45℃ | +++ | +++ |
| | 50℃ | +++ | +++ |
| | 55℃ | - | ++ |
| | 60℃ | - | - |

生育状態：-：生育せず、+：やや生育する、++：よく生育する、+++：非常によく生育する

[0027]
[Table 2]
表２　新規微生物の性質

| 微生物名 | | | バチルス・スピーシズ（*Bacillus sp.*）Ｑ２－１株 | バチルス・スピーシズ（*Bacillus sp.*）Ｑ３株 |
|---|---|---|---|---|
| 生命工研菌寄番号 | | | 16922 | 16923 |
| （ｃ）生理学的性質 | | | | |
| (1) 硝酸塩還元 | | | + | + |
| (2) 脱窒反応 | | | - | - |
| (3) ＶＰテスト | | | - | + |
| (4) インドール生成 | | | - | - |
| (5) 硫化水素生成 | | | - | - |
| (6) デンプン加水分解 | | | - | - |
| (7) クエン酸利用 | Ｋｏｓｅｒ培地 | | - | + |
| | Ｃｈｒｉｓｔｅｎｓｅｎ培地 | | + | - |
| (8) 無機窒素源利用 | 硝酸ナトリウム | | - | - |
| | 硫安 | | - | - |
| (9) 色素生成 | | | - | - |
| (10) ウレアーゼ | | | - | - |
| (11) オキシダーゼ | | | + | - |
| (12) カタラーゼ | | | + | + |
| (13) ＤＮアーゼ | | | + | - |
| (14) 酸素に対する態度 | | | 好気性 | 好気性 |
| (15) ＯＦテスト | | | O | F |

[0028]
[Table 3]

表3　新規微生物の性質

| 微生物名 | | パチルス・スピーシズ（Ｂａｃｉｌｌｕｓ ｓｐ．）Ｑ２－１株 | パチルス・スピーシズ（*Ｂａｃｉｌｌｕｓ* ｓｐ．）Ｑ３株 |
|---|---|---|---|
| 生命工研菌寄番号 | | 16922 | 16923 |
| （ｃ）生理学的性質 | | | |
| (16) 糖からの酸の生成 | Ｌ－アラビノース | + | + |
| | Ｄ－キシロース | + | + |
| | Ｄ－グルコース | + | + |
| | Ｄ－マンノース | + | + |
| | Ｄ－フラクトース | + | + |
| | Ｄ－ガラクトース | + | + |
| | マルトース | + | + |
| | シュークロース | + | + |
| | ラクトース | + | - |
| | トレハロース | + | + |
| | Ｄ－ソルビトール | + | - |
| | Ｄ－マンニトール | + | + |
| | イノシトール | + | - |
| | グリセリン | + | + |
| | デンプン | - | - |

[0029]
[Table 4]
表4　新規微生物のプロテアーゼ活性

| 微生物名 | プロテアーゼ活性（吸光度 280 ｎｍ／ｍｌ・分） | |
|---|---|---|
| | カゼイン培地培養時 | 汚泥培地培養時 |
| パチルス・スピーシズ（Ｂａｃｉｌｌｕｓ ｓｐ．）Ｑ２－１株 | ０．０ | ３９．５ |
| パチルス・スピーシズ（Ｂａｃｉｌｌｕｓ ｓｐ．）Ｑ３株 | ２．４ | ０．９ |

[0030] the result of having tested the result by comparison to Bergey's manual of systematic bacteriology volume 2 (1984) — these two shares — Bacillus pumilus — it turned out that it is the stock of a relative. However, these two shares are the point that nitrate reduction is a positivity, and a bacillus. The sp.Q2-1 share was a new strain to which the point that VP test is negative belongs to Bacillus unlike Bacillus pumilus.
[0031] Although the sludge generated when waste industrial waters are processed with an activated sludge process is being used for the sludge processed by the new microorganism of this invention, it is not limited to this and can fully be applied to processed material which has many fungus bodies in a BOD load, for example, sludge etc.
[0032] When adding the new microorganism of this invention to sludge, every culture medium and a microorganism may be condensed and the microorganism which could add the seed fungus to sludge, could be made to increase in sludge, and was cultivated with sludge or culture medium may be added to sludge. In order to use the secrete of a microorganism furthermore, the culture supernatant of a microorganism may be added to sludge. Moreover, you may use it, combining these addition approaches suitably. By adding as mentioned above, high alkalinity, and an elevated temperature and prolonged acclimatization are not needed, but a sludge disposal can be started.
[0033] pH conditions of the sludge disposal by the new microorganism of this invention have desirable pH 9-12 to pH 8-13 and a pan. With [ pH ] eight [ or more ], this can solubilize sludge efficiently as compared with the time only of only warming, but it is because drug solution cost costs upwards dearly by too high pH and growth of a microorganism becomes difficult. As temperature conditions, 40 degrees C or more 60 degrees C or less are preferably desirable 40 degrees C or more 80 degrees C or less. The condition for growth generally considered to be desirable to propagation of a microorganism is near pH neutrality, and temperature conditions are near a room temperature. For example, the microorganism of an activated sludge tank is 20-30 degrees C, and the highest is also made into 35-degree-C order. It becomes possible to grow the new microorganism of this invention preferentially at the same time it solubilizes sludge by making sludge-disposal conditions into high alkalinity and a high temperature service.

[Translation done.]

EXAMPLE

[Example] Hereafter, although invention is explained in more detail using an example, the range of this invention is not the object limited to this. What diluted the excess sludge collected from the chemistry industrial-liquid-waste treatment facility until MLSS was set to 20,000 ppm was used for the sludge used in the example. The result of each example and the example of a comparison is shown in Table 5.

[0035] Example 1 desiccation bouillon (NISSUI PHARMACEUTICAL) 30 g/L, sodium carbonate Culture medium 5 ml of 10 g/L was put into the test tube (diameter of 18 mm x180 mm length), after sterilizing, inoculation of the Bacillus sp.Q2-1 share (life **** microorganism **** No. 16922) was carried out, and it cultivated by both-way shaking 120 rpm at 45 degrees C for 24 hours, and preculture liquid was obtained. Sludge 32 ml and sodium-carbonate 100 g/L liquid 4 ml were mixed, it put into the flask with a 200 ml ** baffle, and before ****** 4 ml was added. Rotation shaking 120 rpm was carried out at 45 degrees C. The rate of the formation of MLSS reduction three days after processing was 44.5%.

[0036] Example 2 desiccation bouillon (NISSUI PHARMACEUTICAL) 30 g/L, sodium carbonate Culture medium 5 ml of 10 g/L was put into the test tube (diameter of 18 mm x180 mm length), after sterilizing, inoculation of the Bacillus sp.Q3 share (life **** microorganism **** No. 16923) was carried out, and it cultivated by both-way shaking 120 rpm at 45 degrees C for 24 hours, and preculture liquid was obtained. Sludge 32 ml and sodium-carbonate 100 g/L liquid 4 ml were mixed, it put into the flask with a 200 ml ** baffle, and before ****** 4 ml was added. Rotation shaking 120 rpm was carried out at 45 degrees C. The rate of the formation of MLSS reduction three days after processing was 43.7%.

[0037] Using Bacillus sp.Q2-1 share (life **** microorganism **** No. 16922) and Bacillus sp.Q3 share (life **** microorganism **** No. 16923) before ****** obtained in the example 3 examples 1 and 2, sludge 32 ml and sodium-carbonate 100 g/L liquid 4 ml were mixed, it put into the flask with a 200 ml ** baffle, and two before ****** ml each was added. Rotation shaking 120 rpm was carried out at 45 degrees C. The rate of the formation of MLSS reduction three days after processing was 44.8%.

[0038] Example of comparison 1 sludge 32 ml and sodium-carbonate 100 g/L liquid 4 ml are mixed, and it puts into a flask with a 200 ml ** baffle, and is water. 4 ml was added. Rotation shaking 120 rpm was carried out at 45 degrees C. The rate of the formation of MLSS reduction three days after processing was 26.4%.

[0039]

[Table 5]

表５　各実施例１～３と比較例１における処理３日でのＭＬＳＳ減容化率

| | ＭＬＳＳ減容化率 |
|---|---|
| 実施例１ | ４４．５％ |
| 実施例２ | ４３．７％ |
| 実施例３ | ４４．８％ |
| 比較例１ | ２６．４％ |

[Translation done.]